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DEPARTMENT OF TRANSPORTATION

U. S. COAST GUARD

STATEMENT OF

CAPTAIN THOMAS H. ROBINSON

ON ALTERNATIVES IN VESSEL TRAFFIC CONTROL TECHNOLOGY

BEFORE THE

SUBCOMMITTEE ON TECHNOLOGY AND COMPETITIVENESS

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

*** JANUARY 24, 1992 ***

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Good morning, Mr. Chairman. I am Captain Thomas H. Robinson, Chief of Operations in the Eleventh Coast Guard District, headquartered here in Long Beach. I am assisted by Commander Doug Alsip of the Coast Guard Headquarters Radionavigation Division. He is a technical expert on the Global Positioning System (GPS) and the Differential Global Positioning System (DGPS). It is my great pleasure to appear before this distinguished Committee today to discuss new technology in vessel traffic control and radionavigation in confined waters. The Coast Guard is keenly interested in applying new technology in the maritime arena. When new cost-effective technologies are discovered and are proven to work reliably, those that enhance maritime safety or make marine transportation more efficient will be examined by the Coast Guard for possible implementation. The Secretary has stated in the National Transportation Policy that the Coast Guard will assess the need for improved Vessel Traffic Services (VTS) to guide and control ship movements. In addition to my discussion concerning VTS enhancements, I will discuss Electronic Chart Display and Information Systems (ECDIS) and other related applications of the Department of Defense's Global Positioning System, including Differential GPS. Today, I will be unable to discuss H.R. 3969 or the Committee's draft legislation because the Administration's position is still under development.

In response to the Oil Pollution Act of 1990, the Coast Guard is establishing an

Automated Dependent Surveillance (ADS) capability to augment the existing radar surveillance system in Prince William Sound, Alaska. ADS is a technique where a navigation sensor aboard a participating vessel reports its position to the VTS. The VTS electronically queries the vessel over a data communications channel, asking the vessel where it is located. The "black box" aboard the vessel responds with its latitude, longitude, time, course, speed, and a unique identification code. This information is transmitted over, say, a radio link, such as "VHF" (Very High Frequency). A technique called "Digital Selective Calling" has been chosen for the Prince William Sound system. This technique allows individual "interrogation" of each vessel by the VTS. This way, only the black box on the vessel being interrogated sends its position back to the VTS, and control over the communications channel is easily maintained by the VTS. All tank vessels operating in Prince William Sound will be required to install the equipment necessary to participate in the ADS.

In addition to the ADS, we will be installing a state-of-the-art computerized control and data processing system. The sophisticated computer display system at the VTS displays a "blip" on an electronic chart, showing the position of the vessel on the chart in relation to the channel, any hazards in the area and the track line it is supposed to follow. This computer system will also be capable of displaying radar "target" information, superimposed on the electronic chart display. This radar target information is derived at the remote radar antenna location. Radar "blips" extracted from the received radar beam are digitized – in other words, converted into digital form for transmission over a reliable data communications channel to the VTS. The computer can display this information along with chart features such as depth of water, the location of reefs, and ADS position reports electronically transmitted by the vessels.

We are confident that this technology will be capable of being employed in other

Vessel Traffic Systems in the continental United States. The contract statement of work will require only minor modifications for other ports. The biggest difference between Valdez and the major ports in the continental United States is the volume of marine traffic. In Valdez, 2 or 3 vessels will typically be tracked by the system at one time. However, in New York harbor, for example, a hundred or more vessels may be "in the system" at a given time. This can be handled by Digital Selective Calling only if multiple VHF channels are used. Regulatory changes to the maritime frequency spectrum will be needed to provide the necessary channel availability. Failing that, another means of communication will have to be found. Communications satellites will be a possible, though expensive, choice.

The Coast Guard feels that ECDIS technology will eventually be a major boon to maritime safety, once the government converts its charts to digital form and comes up with a means to distribute the charts and their corrections. Standard requirements for the system also need to be adopted. These standards are necessary to ensure that the system is the legal equivalent of the present paper chart. The International Maritime Organization (IMO) has developed proposed performance standards. The Coast Guard, Defense Mapping Agency and National Ocean Service are evaluating these standards, along with industry under the auspices of the Radio Technical Commission for Maritime Services. The Coast Guard is also involved in an ECDIS testbed project (one of four worldwide) to develop, test, and evaluate an ECDIS system meeting the proposed specification. The Coast Guard, National Ocean Service and the maritime industry are co-sponsors of this project. The results of this joint research and development effort should be reported to the IMO by September, 1993. The catalyst that "enables" the use of ECDIS technology is the Differential Global Positioning System. Before I discuss DGPS, I will briefly explain how the parent system, GPS, works.

The GPS satellite navigation system, developed and managed by the U.S. Air Force, will consist of a constellation of 24 satellites (21 operating satellites plus 3 "spares") in orbit about 11,000 miles above the Earth by the end of 1993. Each satellite occupies a predetermined position in this constellation, and circles the Earth every 12 hours, providing measurements which allow GPS receivers aboard ships anywhere in the world to calculate their location, speed and time very precisely. There are now 16 satellites in orbit, providing about 22 hours of "coverage" per day for maritime purposes.

The Air Force provides two levels of accuracy with GPS. The Precise Positioning Service (PPS) gives military users with access to cryptography equipment a positioning accuracy of 17.8 meters. Most mariners won't have access to this level of service. The Standard Positioning Service (SPS) provides an accuracy of 100 meters using a technique called Selective Availability (SA), where the satellite data is intentionally degraded for national security reasons. Loran-C, an existing radionavigation system covering coastal waters, provides 500-meter accuracy.

Differential GPS improves upon the standard positioning service in a localized area by using a reference receiver located at a known position to correct both natural and man-made errors in the satellite signals. The reference receiver monitors all visible satellites, continuously computing corrections and broadcasting them to users within the local area over a separate communications link. These corrections are then applied to received satellite signals within the vessel's DGPS receiver, achieving a highly accurate position. The 100-meter GPS accuracy is thus improved to better than 10 meters. It was never the purpose of DGPS to circumvent the Selective Availability scheme employed by the Air Force. DGPS <u>does</u> allow a more accurate use of GPS over a limited area for many navigational purposes, but the DGPS system is governed by applicable Statutes, including a requirement that it be turned off when so ordered by the President for national security reasons.

DGPS will provide unprecedented accuracy to mariners approaching and navigating within our ecologically vulnerable harbors. It will also improve the "integrity" of the GPS system for maritime use. "Integrity" is the ability of a navigation system to warn the user when it should not be used. Since the reference receiver knows its position, it can immediately detect when a satellite is transmitting erroneous data and can either automatically correct it or warn the mariner.

The Federal Radionavigation Plan, jointly prepared by the Department of Defense and Department of Transportation, outlines navigation accuracies needed for the different phases of navigation. While the requirements for ocean and coastal radionavigation have been satisfied for some time, requirements for the harbor and harbor approach phases have never been satisfied. Additionally, a similar need exists for other Coast Guard missions such as buoy positioning and VTS. Other agencies, such as the National Ocean Service and the Army Corps of Engineers have similar requirements for some of their operations. DGPS provides a solution to these needs.

Experimental DGPS stations are now operating in the New York/New England area, the St. Mary's River area of Michigan, and the southern coast of Texas. As I stated earlier, a similar system will be installed in the Prince William Sound area of Alaska, and will be the position sensor for the dependent surveillance system there.

The DGPS station in New York was put to a real test last summer after Hurricane Bob battered the northeast coast. After the hurricane, there were more than 1,000 buoys whose positions needed to be verified before normal navigation could resume. Checking this number of buoys is normally about a year's workload. The manual method of positioning buoys with sextants is time-consuming and comes to a halt in low visibility. But with a DGPS receiver and laptop computer running a position display program, positioning time is reduced from an hour or more to only about five minutes per buoy, and can be done in any visibility. Four days after the hurricane hit, the waterways were reopened to vessel traffic. The U.S. Navy also used DGPS extensively in the aftermath of Operation Desert Storm to locate and remove unexploded mines.

The Coast Guard intends to evaluate DGPS service for harbor and harbor approach areas of the coastal United States, including the Great Lakes, Puerto Rico and most of Alaska and Hawaii. The project is scheduled for completion in January, 1996.

In conclusion, the Coast Guard's experience with DGPS has shown the concept to be valid, and it has proven its effectiveness in operational missions. The users appreciate its ease of use and the time it saves them. I believe that the implementation of DGPS will significantly enhance maritime safety in the United States. I have described this technology to illustrate some objectives that we are pursuing. New technologies such as GPS, DGPS and ECDIS will allow ships to navigate more safely; however, they will not remove the human factor in inherently unsafe practices such as navigating a vessel at excessive speeds in restricted visibility, or errors in judgment such as colliding with a bridge because of miscalculating vertical clearance. We should be careful to coordinate our efforts with those in the international community; for example, IMO standards on ECDIS. We should also assess results from the OPA-90 studies before moving ahead with legislation concerning these technologies.

Thank you very much, Mr. Chairman. We will be happy to answer any questions you may have.